Amendments to the Specification

Please replace the paragraph at lines 15-18 on page 15 with the following amended paragraph:

In step 610, the compressed message is encoded by utilizing an error correction code with an output alphabet L to generate a message encoded in a sequence of Q symbols. This encoding step provides robustness to errors in the channel 514. For example, a standard <u>16 → 31</u> ~~16 ? 31~~ bit BCH code that corrects for three errors, where <u>L=4</u> ~~L ? 4~~ (2 bits) can be used.

Please replace the paragraphs at lines 1-20 on page 16 with the following amended paragraph:

In step 630, an image area corresponding to R logo matrices is used for pre -defined fiducial marks. For example, the four corners of the image can be reserved for fiducial m arks. In each corner, an area of <u>4 × 4</u> ~~4 ? 4~~ pixels (<u>2 × 2</u> ~~2 ? 2~~ matrices) can be designated for fiducial marks. The fiducial marks can be the whole area rend, except for an isolated location in each corner that is set apart or separate from adjacent matrices, which is rendered black. The upper -left fiducial mark, for example, can be all white except for the upper -left pixel, which is rendered black. It is preferable that the pattern for the fiducial mark be as robust to channel noise as possible. Since dots may be blurred or move relative to each other due to noise in the channel 514, this pattern ensures that the black fiducial dots do not merge with neighboring dots, and instead stand out clearly on a white background. Various other fiducial patterns can be utilized depending on the particular types of noise in a particular channel of interest.

In step 640, the remaining logo matrices (i.e., P = M x N/(K x K) – R logo matrices) are converted to K x K binary barcode matrices by utilizing one of a predefined set of L distinct maps (e.g., halftoning algorithms) based on a corresponding symbol in the coded message. In one example, there are 784 remaining image -matrices (based on N =80 and M =40) that can be ordered in raster scan. The 784 image matrices can accommodate slightly more than 25 batches of 31 matrices (<u>Q = 25 × 31 = 775</u> ~~Q - 25 - 31 - 775~~). It is important to note that P should be greater than Q. Each batch codes two batches of 16 input bits: (1) one batch for the BCH MS bits, and (2) the other batch for the BCH LS bits. Thus, for the parameters specified above, the barcode can encode <u>25 × 16 × 2 = 800</u> ~~25 - 16 - 2 - 800~~ bits of information.

Please replace the paragraph at page 17, line 17, through page 18, line 6, with the following amended paragraph:

There are many rendering methodologies from which one can choose the L distinct maps. For example, when halftoning algorithms are selected as the L distinct maps, there are many types ~~type~~ of halftone methodologies one can choose from. In an exemplary implementation a fixed-halftone pattern halftoning method is utilized. This method specifies that the image be a 2-tone image. If black is 0, and white is 1, the bright tone b, and the dark tone d, are such that $d=1-b$ ~~d ? 1 ? b~~. Also, the L halftoning algorithms correspond to L distinct $K \times K$ ~~K ? K~~ pattern-matrices, where each pattern matrix contains $b \cdot K \times K$ ~~b ? K ? K~~ black dots on white background. However, it is noted that other well-known halftoning methods, such as cluster dithering, disperse dithering (e.g., blue noise), and error diffusion methods can be utilized. When an error diffusion algorithm is employed, one can select from many different methods to diffuse the error. Similarly, when a disperse dithering algorithm is utilized, one can select from many methods to define the dither matrices (also known as screens) of various sizes.

Please replace the paragraph at page 20, line 19, through page 21, line 2, with the following amended paragraph:

In step 840, the acquired barcode image is partitioned onto a plurality of sub-images that can be arranged in a rectangular array, where each sub-image corresponds to a single barcode matrix. Step 830 provides a rectangular image. In one embodiment, the step of partitioning the acquired barcode image involves the steps of measuring the image and slicing the image into rectangular, sub-images. In our case, M/K=20 ~~M/K?20~~, and N/K=40 ~~N/K?40~~ so each rectangular sub-image had the dimensions of 20×40 ~~20 ? 40~~.

Please replace the paragraphs at lines 13-17 on page 21 with the following amended paragraph:

In step 860, a best match is selected to represent the sub -image in a sequence of P symbols over {1, 2, ..., L ~~1,2,? L~~}. It is noted that any maximum-likelihood-type of detector or any other match estimator can be utilized to determine which of the L possible maps (e.g., halftones) is the most likely to have produced the corresponding sub -image. Preferably, the best match is performed on a group of sub-images.